PART I

No. 1

Indian Airlines Corporation, Douglas DC-3, VT-CFB, crashed 10 miles north of Safdarjung Airport, New Delhi, India, on 13 March 1957. Report released by the Office of the Director General of Civil Aviation, India.

Circumstances

VT-CFB took off from Safdarjung Airport at approximately 0832 hours Indian Standard Time on a training flight. At 0839 it reported as being 20 miles north of Safdarjung Airport and at 5 000 ft. There was no further radiotelephony contact with the aircraft. At approximately 0915 hours it crashed 10 miles north of Safdarjung Airport and was destroyed by impact and fire. Both occupants were killed as were three inmates of a hut in the labour colony where the crash occurred.

Investigation and Evidence

This was the first of a series of approximately eight flights to train a captain as a flying instructor.

The instructor's total flying experience exceeded 12 000 hours including almost 5 000 hours (4 381 in command) in DC-3 aircraft. The "trainee" had a total of 5 874 hours to his credit, including over 5 000 hours (1 434 in command) in DC-3 aircraft.

No proper load sheet was prepared for this flight and in the absence of such a document the laden weight of the aircraft was estimated at approximately 24 380 lbs at the time of take-off.

2 550 lbs of ballast were stated to have been put on board the aircraft. The absolute accuracy of this figure is accepted with some hesitation as the loading of ballast was done under the supervision of a chief loader whose evidence was not entirely convincing. Evidence as to the effective lashing of the ballast was conflicting. Considering that thirteen ballast bags were recovered from the front section of the burned out wreckage without any rope suitable for tying down and also that the instructor on the first flight that morning stated that the ballast placed between the seats was not lashed and ballast in the front and rear luggage compartments was covered by network only, it was accepted that the ballast on board was not lashed.

So far as the actual distribution of the load was concerned, it was reasonable to assume that the centre of gravity of the aircraft was within permissible limits at the time of take-off as the DC-3 type of aircraft permits a wide latitude in loading and also the instructor who used this aircraft on a training flight just prior to the subject flight did not report anything abnormal in the trim of the aircraft.

Results of the Inspection of the Wreckage

It was concluded that the aircraft hit the ground in a straight steep dive; there was no structural failure of the aircraft while in the air, nor was there any fire in flight. All control surfaces were functioning when the aircraft hit the ground.

On examination of the engines no evidence was found of internal failure and there were no signs of inadequate lubrication. Both engines were developing power at the time of impact.

The Instructor's Course

On the subject of training instructors the chief pilot of Indian Airlines Corporation

stated, "Broadly speaking, the complete syllabus for the pilot-in-command checks is gone through with special accent on the speed and manoeuvre limitations. With particular reference to the first period since this seems to be relevant, the manoeuvres include change of speeds, change of heights, turns and stalls. I have no first-hand knowledge what was intended to be done on this flight as this subject was not referred to me, but during the first flight the manoeuvres referred to above are normally undertaken. The exercise of approaching to stall is generally done twice - once with full flaps and undercarriage retracted and then with flaps and undercarriage extended and normally in this order. From the time period and considering that the aircraft was airborne at approximately 0832 hours and presuming that the crash occurred approximately between 0915 and 0920 hours, he could have reached this stage of demonstration of stall because the trainee was quite capable of doing these initial exercises quickly."

The chief pilot believed, however, that during all these exercises the instructor would normally be in the right-hand seat and the only time he would occupy the left-hand seat "would be either if the aircraft is not behaving as it should or when the aircraft is tending to go out of control." No height for these exercises has been specified, but "it is normal practice for these exercises to be done at about 4 000 ft above ground level and never below 3 000 ft in any case. This is done for two reasons - one to have a good safety margin and the other to be out of approach and circuit height."

A previous trainee trained by the subject instructor stated - "..For the first flight I occupied the left-hand seat and he asked me to do various exercises... The next session, I occupied the right-hand seat and most of the exercises that I carried out the previous day were carried out from the right-hand seat... the approaches to stall were done by myself from the right-hand seat with power on, power off, gear down, gear up, flaps down, flaps up. The exercise was approaching to the stalling point up to the aircraft shuddering and buffeting and just before the nose of the aircraft dropped, the corrective action was carried out. He also acted as a pupil and approached to stall from the left-hand seat and expected me to find out if there was any defect in technique. He emphasized that all these exercises are always to be carried out above 6 000 ft, above ground level and these exercises were conducted above 6 000 ft."

Reconstruction of the Flight of VT-CFB

After taking off with the instructor in the left-hand seat, the aircraft proceeded to an area about 20 miles to the north of the airport. Some exercises were commenced at a height of 5 000 ft above mean sea level.

The very nature of this instructor's course required the pilot under training to take corrective action in case of a faulty manoeuvre. During one of these manoeuvres, which included an approach to stall, the aircraft entered a spin. It would appear that this spin was entered inadvertently as intentional spins are prohibited in DC-3 type aircraft. Corrective action was taken and although partial recovery had been effected, the height available was insufficient for the aircraft to recover from the ensuing dive when it hit the ground.

The circumstances of this accident closely resemble another which occurred in the U.S.A. in 1951.* During the investigation of that accident it was established that the DC-3 aircraft has normal stall characteristics with ample warning of the approaching stall being given before control is lost. The stall is, however, more abrupt and occurs with less warning when the flaps and undercarriage are retracted. In this configuration the aircraft has a tendency to fall off on one wing.

The following data were obtained from the wind tunnel studies made by the

* ... this aircraft was estimated to be at a height of 3 200 ft above the terrain when it stalled and entered into a spin.
ICAO Note:- See also Summaries No. 4, 34 and 38 in this Digest.

National Advisory Council for Aeronautics, using a DC-3 model and analyzing the aircraft's aerodynamic characteristics: "While the tests gave evidence that spin recovery is normal, an altitude loss of approximately 3 000 ft can be excepted prior to a full recovery. Such altitude loss would be particularly true in the event a power-on spin was experienced. The spin would be steep with the nose down about 55 degrees from the horizontal, and the rate of descent would be about 10 500 ft per minute..."

Once V T-CFB entered a spin, it behaved in the classic manner and reproduced all the manoeuvres described in the N.A.C.A. study. No minimum height for these exercises has been laid down. A figure of 4 000 ft above msl corresponds to 3 300 ft above the ground at the accident site. If this was the height at which the aircraft stalled and entered into a spin, then it did not permit a sufficient margin of safety. A minimum altitude of 7 000 ft to 8 000 ft above ground appears desirable.

An additional complication in this case seems to be a probability. The unlashed ballast although it would have retained its position in normal flight, could have shifted after the aircraft became uncontrolled in a spin. It is difficult to calculate the exact effect of this displaced ballast on the aircraft, but one fact can be stated with certainty and that is that it was not a helping factor in the recovery from the spin and might have added to the minimum height that was necessary for the recovery.

Probable Cause

The accident was attributed to loss of control of the aircraft as a result of a spin, inadvertently entered into at a height too low for recovery.

Recommendations

1. A minimum height, which permits adequate margin of safety for recovery, should be specified for training exercises in DC-3 type aircraft during which there is even a remote possibility of the aircraft entering a spin.

2. A public transport aircraft shall not fly unless written loading instructions have been given by the operator to the person superintending the loading of the aircraft instructing him how the load is to be distributed and secured.

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Training
En route
Stall

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